

A REVISED DESCRIPTION OF THE SALT MARSH RUSH, *JUNCUS ROEMERIANUS*.

LIONEL N. ELEUTERIUS
Gulf Coast Research Laboratory
Ocean Springs, Miss. 39564

ABSTRACT

A reevaluation of nine taxonomic characteristics presently used to identify *Juncus roemerianus*, in view of recent morphological, populational and distributional information, indicates that existing descriptions are inadequate or incorrect. A new description of the species is given.

INTRODUCTION

Juncus roemerianus Scheele is found only on the east coast of North America (Weimarck 1946, Eleuterius 1975), where it produces a copious vegetational cover over tidal marsh on the south Atlantic and Gulf Coasts of the United States (Eleuterius 1976a). During a recent autecological study of the species two distinct plant types were recognized based on flower morphology. One plant type was hermaphroditic, bearing perfect flowers and the other was female, bearing imperfect, pistillate flowers (Eleuterius and McDaniel 1974, Eleuterius 1974). The plants spread rapidly by means of vigorous rhizome growth and a single plant type may dominate several acres or more of tidal marsh (Eleuterius In review a). In view of these and other recent findings the biological characteristics presently used to identify and describe *J. roemerianus* need reevaluation and clarification. Manuals used to describe this plant have erroneous descriptions. The salient taxonomic features of the plant species have not been previously recognized, thus inadequate descriptions prevail. Although I have studied herbarium specimens of other members of the *Junci Thalassi* of which *Juncus roemerianus* is a member, I feel that this "classical" approach may perpetuate existing errors in the literature. This paper covers nine taxonomic features and the reasons for the needed change. A revised description of the tidal marsh rush is given.

Historical sketch. Scheele (1849) first described and named *Juncus roemerianus* from plants bearing flowers collected on Mustang Island at Galveston, Texas. Prior collections of the species from North America were considered *Juncus maritimus*, the European form named by Lamarck (1789). However, Chapman (1860) discovered an isolated colony of true *J. maritimus* on Long Island, New York. Later authorities such as Coville (1894) cite Chapman as the author of *J. maritimus*. Although Scheele discovered what he considered a new species, he did not describe the distinctive features of *J. roemerianus*. Engelmann (1861-1868) described the plant

and pointed out some of the distinct characteristics which separate it from the closely allied *J. maritimus*. This separation was based primarily on seed morphology. He also stated that he found "a rare form of *J. roemerianus* where both circles of stamens were suppressed or rather underdeveloped and in a rudimentary state so that those plants became unisexual." He also noted that *J. roemerianus* was the only species of *Juncus* which produce unisexual plants. Corresponding male plants were not seen, but he suggested that they may exist. The specimens that he observed were from Georgia and Florida. Other early workers such as Coville (1894), Chapman (1897), Small (1903), and Blankinship (1903) listed *J. roemerianus* in their papers or manuals.

Breeding system. Chapman (1897) and Fernald (1950) stated that *Juncus roemerianus* was dioecious and Small (1903, 1933) suggested that the "flowers were usually dioecious." Radford et al. (1968), Correll and Johnston (1970), Correll and Correll (1975), Gleason (1968) and Jones (1975) considered the species to be hermaphroditic, having perfect flowers. However, Gleason (1968) stated that the stamens were "usually none in fertile flowers." Long and Lakela (1972) described the flowers as unisexual, but do not clarify their distribution. Thus, the species may be assumed to be monoecious or dioecious.

In recent work, only perfect and pistillate flowers have been found, although thousands of inflorescences of *Juncus roemerianus* have been examined (Eleuterius and McDaniel 1974). Collections were taken from Mississippi, Texas, Louisiana, Alabama, Florida, Georgia, South Carolina and North Carolina. Extensive study of the rhizomes during anthesis shows that they bear culms with inflorescences composed exclusively of pistillate or perfect flowers. A given rhizome produced only one flower type, never both. Transplanted clonal material from unisexual and bisexual plants have for five years consistently produced only the respective flower type (Eleuterius and McDaniel 1974, Eleuterius 1974, In review b). Plants grown from seed have also consistently produced a single flower type (Eleuterius, In review c).

I have also searched in vain for staminate flowers in plants comprising mature stands and in the progeny of known parental types from widely separated areas. Only plants with pistillate or perfect flowers are apparently produced. These data offer sufficient proof that the species is gynodioecious.

Involucral bract. The terminal bract is erect and terete and appears to be a continuation of the stem. Correll and Johnston (1970) and Correll and Correll (1975) state that the terminal bract is 3 times as long as the inflorescence. Observations of plants in various habitats indicate that this feature is unreliable as a taxonomic characteristic since the bract may range from 2—90 cm in length and may be from ½—10 times the length of the inflorescence.

Inflorescence morphology. Small (1903, 1933) described the culm as a scape, while Correll and Johnston (1970), Correll and Correll (1975) state that the inflorescence is a panicle, with compound branching, 7–12 cm in length. Buchenau (1906) described the inflorescence as a panicle, but did not indicate size. Gleason (1968) stated that inflorescence was 6–15 cm in length.

Recent work corroborates paniculate descriptions of the inflorescence; however, the form and size are extremely variable between populations (Eleuterius 1974). The inflorescence may vary from a few- to a many-branched panicle. The length of the inflorescence branches may vary, producing in some instances tufted inflorescences. The reason for this phenomenon is unknown. In most instances the inflorescence is loosely branched, but ranges from 2–45 cm in length. The variations within populations is relatively small; however, that between certain populations is considerable, differing by 100 orders of magnitude or more (Eleuterius, In review a). The cause of this variation is presently unclear, but under investigation.

Flower cluster. Correll and Johnston (1970) and Correll and Correll (1975) indicate that the flowers occur in clusters of 2–5. Gleason (1968) states that the sessile clusters occur in groups of 2–4, with two to six flowers in each. I find that the sessile clusters occur in groups of 2–6, with from 2–8 flowers per cluster. The solitary flowers referred to by Jones (1975) are obviously immature, since flower development occurs sequentially in each cluster (Eleuterius, 1974, 1975).

Bracteole. Eleuterius (1974), Gleason (1968) and Correll and Johnston (1970), Correll and Correll (1975) point out that each flower is subtended by a short, ovate bract. I have not observed any occasional extra bract mentioned in the latter two references cited above which may represent a feature peculiar to a localized population on the Texas coast.

Capsule. Descriptions of the capsule in the major taxonomic reference manuals are highly variable. This is understandable since the mature capsule of each flower type is distinctly different, a fact not recognized until recently (Eleuterius and McDaniel 1974). Certain populations produce inflorescences with occasional capsules containing 6–8 carpels, suggesting genetic aberration.

Seeds. Only Gleason (1968), Long and Lakela (1972), and Radford et al. (1968) present descriptions of the seeds, although they are obviously important in separating *Juncus roemerianus* from closely related species. Many seeds, especially from hermaphroditic plants, apparently do not reach maturity; these are undersized, transparent and have low viability. Since seed development is rapid, reaching maturity in 3–5 weeks (Eleuterius 1975), and each capsule encloses seeds in different stages of development, the difference, although slight, is sufficient to merit special attention in identification. The seeds may be elongate, wedge-shaped or round, generally not caudate, but often with a slight point at one end. Englemann (1861-

1868) stated that the only apparent difference between *J. roemerianus* and the European *Juncus maritimus* Lam. is the presence in the latter of a minute hooked appendage at one end of the seed. This is questionable and merits further study.

Plant form and size. Correll and Johnston (1970) and Correll and Correll (1975) state that *Juncus roemerianus* is a tufted perennial. Long and Lakela (1972) state that it occurs in large tufts with the culms spaced in rows on horizontal scaly rhizomes. While these statements are essentially true, *J. roemerianus* generally does not grow in tufts, like *Juncus effusus* L., because the erect shoots are widely separated by long rhizomes. The inter-shoot distance along the rhizomes of *J. effusus* is very short, producing a closely arranged, dense mass of erect shoots or tuft. The elongated, spreading rhizome of *J. roemerianus* is apparently unique among rushes (Eleuterius 1976b), especially in context of species found in dry ground or freshwater marshes. Although I have examined *Juncus gerardii* L. from New England, I have not examined adequate material of the European *J. maritimus* or the South American *J. acutus* var. *leopoldii* (Parlatore) Buchenau and other taxa inhabiting saline tidal marshes.

Small (1903, 1933), Correll and Johnston (1970), Gleason (1968) state that the height of *Juncus roemerianus* varies from 5–12, 5–15, 4–10 dm, respectively. Jones (1975), Long and Lakela (1972) and Radford et al. (1968) state that the species is 1, 1.5 and 0.5–1.5 m tall respectively. Mature plants (bearing flowers) have been collected ranging in height from 0.3–2.5 m. Plant height is generally uniform within a given stand, but very different between stands. The "average" height of *J. roemerianus* observed throughout the range of the species probably lies somewhere between 10.5–13.5 dm.

Period of anthesis. Correll and Johnston (1970) state that flowering occurs in the spring, while Long and Lakela (1972) state that it occurs in the fall. Radford et al. (1968) indicated that anthesis covers a period from May to October while Jones (1975) indicates the period extends from March to June. Direct observation on flowering over a wide range of habitats and through a number of years, study of herbarium collections and personal communication with a number of coastal researchers have provided adequate information to clarify the above inconsistencies. In North Carolina the species produces flowers from January to June, in extreme south Florida the species flowers during March and April, while in Mississippi it occurs from January to April. This longitudinal gradient suggests that the length of time that the plants are subjected to low temperatures (followed by increasing day length) is a critical factor influencing the duration of anthesis. The longer cold periods, apparently, correspond to longer periods of anthesis. The above reference indicating that flowering occurs in the fall is erroneous, although the dead culm with intact capsules may exist for a year or more (Eleuterius 1976b). When wet the empty capsules close. Plant workers less familiar with the species probably collected specimens with this persistent culm during the fall, thus, the irregularities.

The following revised taxonomic description summarizes the preceding subject discussions and presents other morphological details of value in identifying *Juncus roemerianus*.

JUNCUS ROEMERIANUS Scheele

Stout, rigid, densely spreading, gynodioecious perennial, with erect shoots 1.5–23.0 dm high; *leaves* all basal, terete, longer than the culm, the sheaths inflated with free margins, dark green with grey or brownish cast, auricles well developed to several mm high, cartilaginous; *culms* terete, pungent, less rigid than leaves; *involucral bract*, stout, spinescent, varying in length from a few cm to 3 dm or more, conspicuous, generally longer than the inflorescence, resembles leaf in cross-section; *inflorescence* paniculate, scape branches very unequal, 2–30 mm long; *flowers* perfect and pistillate on separate plants, 2–8 in small clusters, each flower subtended by bracteole; *perianth segments of perfect flowers* about 4 mm long, pale brown, glossy, indurate, the outer broadly lanceolate, obtuse to acutish, with a broad scarious margin, often subtended by a minute auricle, the inner tepals shorter, acute to obtuse at the scarious-margined apex; *stamens*, 6 nearly equaling the perianth, the anthers 1.5–2.5 mm long, about five times longer than stout filaments; *stigmas* yellow or light brown; *capsule* subglobose, obtuse, mucronate, 5 mm or less long, the valves rigid, equal or shorter than the perianth, *seeds from perfect flowers* obvoid, acute to slightly tailed at one end, finely reticulate to striate, pale yellow to light brown to brown, 0.3–0.6 mm; *perianth segments of pistillate flowers* same as above, except shorter, 3 mm long, reddish brown with a short staminoid at the base of each tepal, *stigmas* much exceeding the perianth, red; *capsule* about 5.5 mm long, much exceeding the perianth; *seeds from pistillate flowers* obvoid, acute to slightly tailed at one end, finely reticulate, brown to dark brown, 0.4–0.6 mm.

Tidal marshes from Delaware to south Florida and westward to Texas. Anthesis occurs from January to June in North Carolina, the period becoming shorter southward and restricted to March and April in extreme south Florida. Westward from northern Florida into Texas, anthesis occurs from January to April. Seeds are shed about four weeks after the flowers reach maturity.

REFERENCES

- BLAKINSHIP, J. W. 1903. The plant formations of eastern Massachusetts. *Rhodora* 5:124–136.
- BUCHENAU, F. 1906. Juncaceae. In Engler. *Das Pflanzenreich*. 25(IV.36):1–284.
- CHAPMAN, A. W. 1860. *Flora of the southern United States*. 1st ed. Cambridge, Mass. 493p.
- . 1897. *Flora of the southern United States*. Cambridge, Mass. 3rd ed. 520p.
- CORRELL, D. S. & H. B. CORRELL. 1975. *Aquatic and wetland plants of southwestern United States*. Stanford University Press, Stanford, California. 1777p.
- & M. C. JOHNSTON. 1972. *Manual of the Texas flora*. Texas Research Foundation, Renner, Texas. 1881p.
- COVILLE, F. V. 1894. Juncaceae. *Mem. Torr. Bot. Club* 5:105–108.

- DAVIS, P. H. & V. H. HEYWOOD. 1967. Principles of angiosperm taxonomy. D. Van Nostrand Co., Inc., New York.
- ELEUTERIUS, L. N. 1974. An autecology study of *Juncus roemerianus* Ph.D. dissertation. Mississippi State University. 221p.
- and SIDNEY MCDANIEL. 1974. Observations on the flowers of *Juncus roemerianus*. *Castanea* 39:103—108.
- . 1974. Flower morphology and plant types within *Juncus roemerianus*. *Bull. Mar. Sci.* 24(5):493—497.
- . 1975. The life history of the salt marsh rush, *Juncus roemerianus*. *Bull. Torrey Bot. Club* 102(3):135—140.
- . 1976a. The distribution of *Juncus roemerianus* in the salt marshes of North America. *Chesapeake Sci.* 17(4):289—292.
- . 1976b. Vegetative morphology and anatomy of the salt marsh rush, *Juncus roemerianus*. *Gulf Res. Reports* 5(2):1—10.
- . In review a. Population structure of the gynodioecious salt marsh rush, *Juncus roemerianus*.
- . In review b. Transplantation of the salt marsh rush, *Juncus roemerianus* to dredge spoil.
- . In review c. Sex distribution in the progeny of the gynodioecious rush, *Juncus roemerianus*.
- ENGELMANN, G. 1861-1868. A revision of the North American species of the genus *Juncus*. *Trans. Acad. Sci. St. Louis* 2:424—498.
- FERNALD, M. L. 1950. Gray's manual of botany. 8th Ed. American Book Company, New York. 767p.
- GLEASON, H. A. 1952. Illustrated flora of the northeastern United States and adjacent Canada. The New York Botanical Garden, Hafner Publishing Co., Inc. New York. 1:1—482.
- GRANT, V. 1975. Genetics of flowering plants. Columbia University Press, New York. 514p.
- JONES, F. B. 1975. Flora of the Texas coastal bend. Misson Press, Corpus Christi, Texas. 262p.
- LAMARCK, J. B. 1789. *Encyclopedie Methodique. Botanique.* 3:264.
- LONG, R. & O. LAKELA. 1972. Manual of the flora of tropical Florida. University of Miami Press, Coral Gables, Florida. 692p.
- RADFORD, A. E., H. E. AHLES, & C. R. BELL. 1968. Manual of the vascular flora of the Carolinas. Univ. North Carolina Press. Chapel Hill, North Carolina. 1183p.
- SCHEELE, A. 1849. Junceae. 1. *Juncus roemerianus*. *Linnaea* 22:348.
- SMALL, J. K. 1903. Flora of the southeastern United States. New York. 256p.
- . 1933. Flora of the southeastern United States. North Carolina Press. Chapel Hill, N.C. 1554p.
- WEIMARK, H. 1946. Studies in Junceae, with special reference to the species in Ethiopia and the Cape. *Svensk. Bot. Tidskr.* 40:131—178.